FEBS Letters 584 (2010) 1941

FEBS Letters
journal homepage: www.FEBSLetters.org

Preface

Intracellular ion channels

Ion-selective channels are widely distributed in intracellular membranes of cell organelles, such as mitochondria, sarco/endoplasmic reticulum, endosomes, lysosomes, synaptic vesicles, and secretory granules. This Special Issue collects 29 contributions organized into six sections, each section dealing with current knowledge of distinct intracellular channels; specifically transporting calcium, potassium, chloride, and other ions; as well as proteins and fatty acids. The rapidly expanding literature shows that intracellular ion channel dysfunctions play a pivotal role in various channelopathies, hence some of these channels were recently identified as interesting drug targets.

The section on calcium channels provides a survey of mitochondrial ryanodine receptors and other mitochondrial calcium-permeable channels, discussing their biophysical and electrophysiological characterization as well as the use of genetically engineered mouse models and how these models contribute to our understanding of the physiological and pathophysiological role of these channels. In addition, new insights are provided into the regulation of endo/lysosomal two-pore calcium release channels and the various plant vacuolar anion and cation channels transporting different ions including calcium.

Three contributions discuss the mitochondrial permeability transition pore, its electrophysiological characterization, regulation, and interaction with mitochondrial potassium channels.

Transient receptor potential (TPR) channels are found in many eukaryotic cells representing ion channels with a surprisingly wide array of cellular functions including taste, smell, and temperature sensation, hormone secretion, and development. Attention is also paid to the mucolipin family of endo/lysosomal TRP channels, how STIM1 gates and regulates the Orais and TRP channels that are implicated in mediating calcium-specific store-operated channel activity, and the yeast vacuolar TRP channel, Yvc1.

The contributions dealing with intracellular potassium channels cover the mitochondrial isoforms found in mammals, plants and unicellular eukaryotes, their role in mitochondrial ROS production and their involvement in the apoptotic cascade.

Additionally, two articles discuss the large conductance Ca^{2+}-activated K^+ channels, BK_{Ca}, their special arrangement between sarcoplasmic reticulum and plasma membrane and implication in arteriolar myogenic signaling, and review knowledge on a new member of the viroporin family, HTLV-1 p13, and its role in sensitizing selected apoptotic stimuli. An important step in apoptosis is mitochondrial outer membrane permeabilization to proteins. Ceramide channels are described as being implicated in this process that is regulated by anti-apoptotic proteins, such as the Bcl-2 family.

Ample scope is given to the discussion on intracellular chloride channels. The articles deal with the proteins assumed to be involved in intracellular chloride transport (ClC, CLIC, bestrophin, Golgi pH regulator) including those in plants, their structure, function, folding, targeting and membrane insertion.

Research over the last years has revealed an amazing multiplicity of intracellular ion channels and their broad functional diversity emphasizing implication and importance of these proteins in many cellular processes. Channel dysfunctions consequently imply distinct pathological conditions that are objects of specifically targeted therapies. These topics are discussed in the last three contributions.

FEBS Letters thanks the authors for contributing to this exciting Special Issue giving an overview on the present state of this field and where it may be heading in the near future.

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Available online 20 April 2010

doi:10.1016/j.febslet.2010.04.032